First analysis of eight Algol-type binaries: EI Aur, XY Dra, BP Dra, DD Her, VX Lac, WX Lib, RZ Lyn, and TY Tri

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Abstract

The available photometry from the online databases were used for the first light curve analysis of eight eclipsing binary systems EI Aur, XY Dra, BP Dra, DD Her, VX Lac, WX Lib, RZ Lyn, and TY Tri. All these stars are of Algol-type, having the detached components and the orbital periods from 0.92 to 6.8 days. For the systems EI Aur and BP Dra the large amount of the third light was detected during the light curve solution. Moreover, 468 new times of minima for these binaries were derived, trying to identify the period variations. For the systems XY Dra and VX Lac the third bodies were detected with the periods 17.7, and 49.3 yr, respectively.

Key words: stars: binaries: eclipsing, stars: fundamental parameters
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1 Introduction

The role of eclipsing binaries in nowadays astrophysics is undisputable. We use the eclipsing binary systems (hereafter EB) for the most accurate determination of the stellar masses, radii, as distance indicators, or as classical celestial mechanics laboratories. We can test the stellar structure models even outside of our Galaxy, see e.g. Ribas (2004). Additionally, also the hidden components can be studied via the dedicated observations of particular binaries as well as the dynamical effects in such multiple systems (Rappaport et al., 2013). Due to all of these reasons the photometric monitoring and analysis of the light

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curves of selected eclipsing binaries still presents a fruitful contribution to the stellar astrophysics.

On the other hand, the available photometry for many interesting eclipsing binaries exists, but some of these EBs were still not analysed yet. Hence, we decided to use mainly the Super WASP photometry (Pollacco et al., 2006) for a light curve analysis and derivation of new minima times for such systems, which were not studied before and their light curve solution is missing.

2 Analysis

The selection criteria for the binaries included in our study were the following. Only such binaries with known orbital periods were chosen, having no light curve solution published up to date, have enough data points for the analysis and also have several published times of minima. The last point was checked via an online archive of minima times observations, a so-called $O-C$ gateway [1] (Paschke & Brát, 2006). Due to the very good time coverage provided by the Super WASP survey we used this database for the whole analysis of the light curve. The other databases such as NSVS (Woźniak et al., 2004), ASAS (Pojmanski, 2002), CRTS (Drake et al. , 2009), or OMC (Mas - Hesse et al. , 2004) were used only for deriving the times of minima for a subsequent period analysis. All of the studied systems are the northern-hemisphere stars of moderate brightness (10 mag < V < 15 mag) and with the orbital periods ranging from 0.9 to 6.8 days.

For analysing the light curves we used the PHOEBE program (Prša & Zwitter, 2005), which is based on the algorithm by Wilson & Devinney (1971). Having sometimes rather limited information about the stars, some of the parameters have to be fixed for the light curve (hereafter LC) solution. At first, the "Detached binary" mode (in Wilson & Devinney mode 2) was assumed for computing. The value of the mass ratio q was set to 1. The limb-darkening coefficients were interpolated from van Hamme's tables (see van Hamme 1993), and the linear cosine law was used. The values of the gravity brightening and bolometric albedo coefficients were set at their suggested values for convective or radiative atmospheres (see Lucy 1968). Therefore, the quantities which could be directly calculated from the LC are the following: the relative luminosities L_i, the temperature of the secondary T_2, the inclination i, and the Kopal's modified potentials Ω_1 and Ω_2. The synchronicity parameters F_1 and F_2 were also fixed at values of 1. The value of the third light L_3 was also computed if a non-negligible value resulted from the fitting process. And finally, the linear ephemerides were calculated using the available minima times for a

[1] http://var.astro.cz/ocgate/

Table 1
The light-curve parameters as derived from our analysis.

Parameter	EI Aur	XY Dra	BP Dra	DD Her
$JD_0 - 2400000$	54050.6460 ± 0.0019	54597.5551 ± 0.0160	54659.5430 ± 0.0013	53165.3571 ± 0.0152
P [d]	1.2266930 ± 0.0000013	2.3152311 ± 0.0000342	0.9868093 ± 0.0000003	5.6433970 ± 0.0000061
i [deg]	87.67 ± 0.59	89.76 ± 0.40	86.97 ± 0.52	79.61 ± 0.35
T_1 [K]	6000 (fixed)	6500 (fixed)	6000 (fixed)	8800 (fixed)
T_2 [K]	6044 ± 38	4343 ± 34	5429 ± 41	4985 ± 50
Ω_1	4.847 ± 0.059	5.942 ± 0.039	5.312 ± 0.052	5.354 ± 0.022
Ω_2	5.181 ± 0.072	4.619 ± 0.020	6.216 ± 0.063	10.671 ± 0.021
L_1 [%]	38.3 ± 0.5	83.7 ± 0.8	45.3 ± 0.9	93.7 ± 0.8
L_2 [%]	32.9 ± 0.7	16.3 ± 0.5	18.5 ± 0.8	6.3 ± 0.6
L_3 [%]	28.8 ± 0.7	0.0 ± 0.0	36.2 ± 0.4	0.0 ± 0.0

particular system.

With the final LC analysis, we also derived many times of minima for a particular system, using a method as presented in Zasche et al. (2014). The template of the LC was used to fit the photometric data from the Super WASP as well as from other surveys. This set of minima times was then combined with the already published minima mostly taken from the $O-C$ gateway (Paschke & Brát, 2006).

3 The individual systems

3.1 EI Aur

The system EI Aur (also GSC 02392-00102) was discovered by Hoffmeister (1936), who also classified the star as an Algol-type. Its orbital period is of about 1.2 days, but there were no light curve or any spectroscopic analysis performed. We can only roughly estimate its type from the color indices, hence we fixed the primary temperature at a value of 6000 K for the whole fitting process.

The Super WASP photometry revealed that it is a detached system, having both minima of roughly equal depths. Therefore, the PHOEBE code was used to these data and the LC fit is presented in Fig. 1, while the LC parameters are given in Table 1. As one can see, the secondary component has almost the same temperature as the primary, hence there is still a doubt which of the minima is the primary one. Another interesting finding is the fact that relatively large contribution of the third light was detected in the LC solution. This would naturally explain why both the minima have only so shallow depths.

One can ask whether the third body detected in the LC solution is somehow gravitationally bounded with the eclipsing pair or is it just a coincidence as a so-called optical binary. We also derived the times of minima from the Super

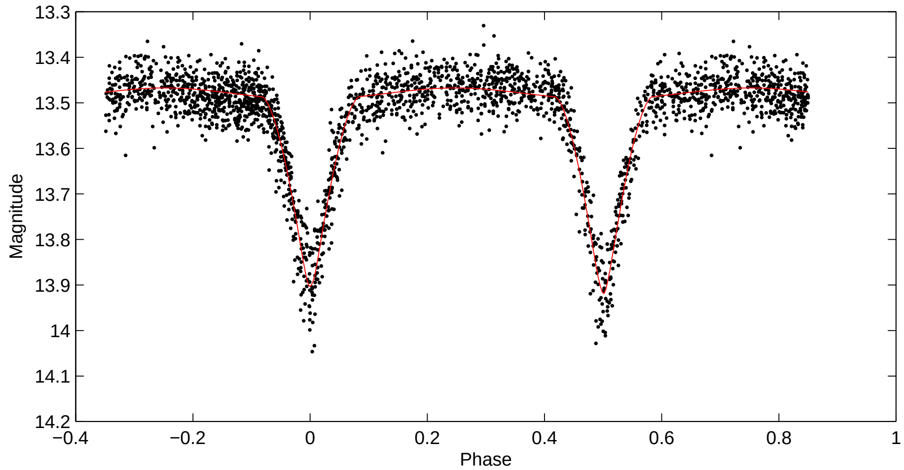

Fig. 1. Light curve analysis of EI Aur, based on the Super WASP photometry.

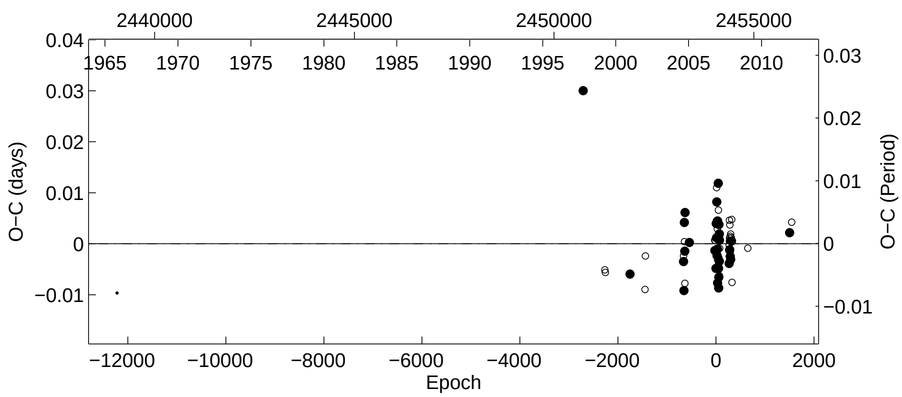

Fig. 2. O-C diagram of times of minima derived from available photometry for EI Aur. The black points stand for the primary minima, while the open circles stand for the secondary ones. The larger the symbol, the higher the weight.

WASP photometry and plotted them together with the already published ones in Fig. 2. As one can see, there is no obvious variation in the times of minima. The data coverage is still rather poor, but even this diagram can be used to set some tighter limits for the parameters of the proposed additional body in the system.

3.2 XY Dra

Eclipsing binary called XY Dra (also AN 391.1929) was discovered as a variable by Wolf (1929). Since then no detailed analysis of this star was carried out, only a few minima times were published, mostly in the last 20 years. Its spectral type is not known, hence we fixed the primary temperature at a value of 6500 K in agreement with the photometric indices as published in different databases.

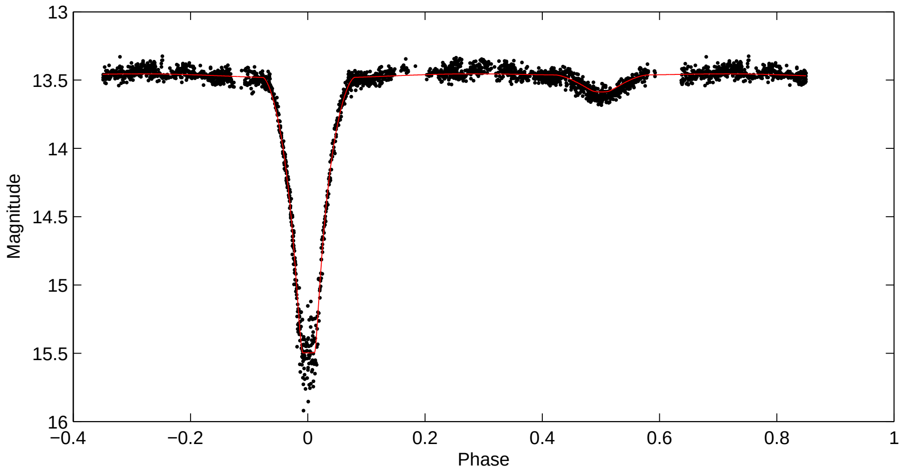

Fig. 3. Light curve analysis of XY Dra, based on the Super WASP photometry.

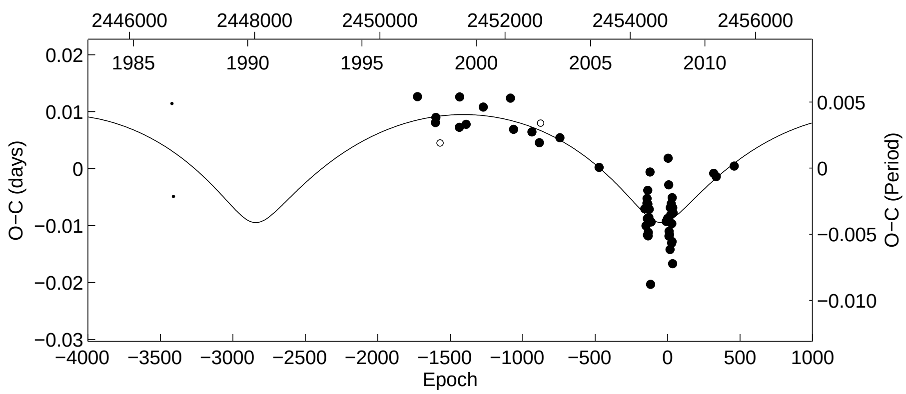

Fig. 4. O-C diagram of times of minima derived from available photometry for XY Dra. The solid curve represents the final fit (see the text for details).

The light curve solution was carried out in the same way as for the previous system, resulting in light curve parameters given in Table 1, while the fit is presented in Fig. 3. As one can see, the primary component is very dominant star in the system and no third light was detected. On the other hand, there still remains an open question whether the data points located in the center of the primary eclipse are real or not. One possible explanation is that there is a total eclipse (as assumed in our fit), or the second explanation could be that we just reached a limit for the Super WASP photometry of about 15.5 mag and the real eclipse is much deeper. Only further dedicated observations of the primary eclipse would reveal its true nature.

Moreover, we also derived the times of minima from the Super WASP photometry and combined them with the already published more precise data from the "O-C gateway". The result of our fitting is presented in Fig. 4. We used a so-called light-travel-time effect for describing the variation in the $O-C$ diagram. This method was described elsewhere, e.g. Irwin (1959) or Mayer (1990), using a set of five orbital parameters for description of the third body

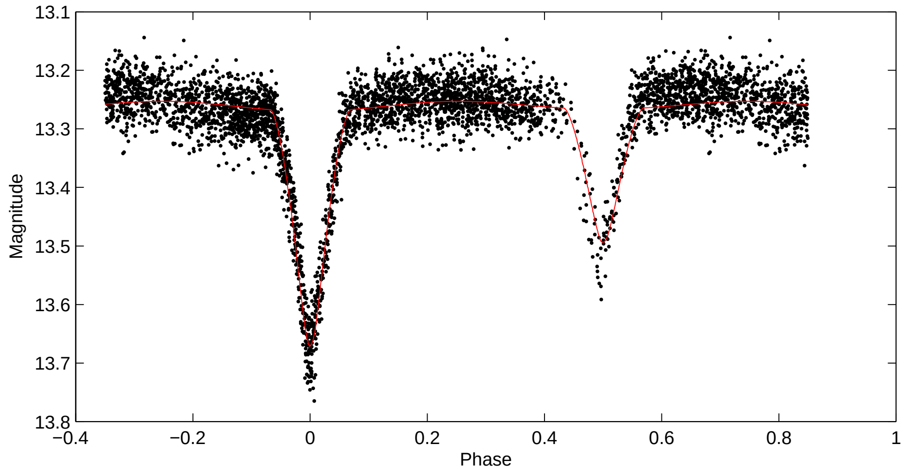

Fig. 5. Light curve analysis of BP Dra, based on the Super WASP photometry.

orbit around the eclipsing binary itself. With this assumption we found that the variation with period of about 17.7 yr, eccentricity 0.59 and a semiamplitude of 0.0095 days is probably caused by a third body of such a small mass that its light contribution to the total light of the system would be negligible. This would be a reason why no third light was detected in the LC solution as presented in Table 1.

3.3 BP Dra

The star BP Dra (also GSC 04231-01877) was discovered by Gessner (1966). It has the orbital period shorter than one day, of about 0.99 days, which makes it rather hard to observe for the minima timings. This is maybe a reason why only so little information is known about this star. Lacking enough data, we have to fix the primary temperature at a value of 6000 K in agreement with the color indices (Skrutskie et al. 2006 and Pickles & Depagne 2010).

The LC solution was found and the parameters are given in Table 1, while the plot with the final fit is presented in Fig. 5. As one can see, both eclipses are rather shallow and the scatter of the observations is quite large. However, this is due to the fact that there was detected also a non-negligible amount of the third light in the LC solution. We can only speculate about its origin and classify the system as a potential triple.

Collecting all available Super WASP photometry we also derived about 50 new minima timings. These data are plotted together with the ones from 1960's and indicate that there is obviously no period change during these fifty years. Only a more detailed analysis would reveal the third-body hypothesis as a plausible or implausible.

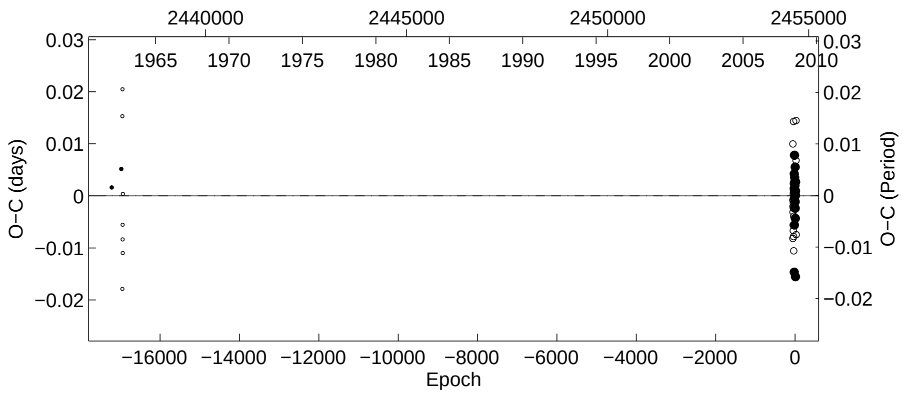

Fig. 6. O-C diagram of times of minima for BP Dra.

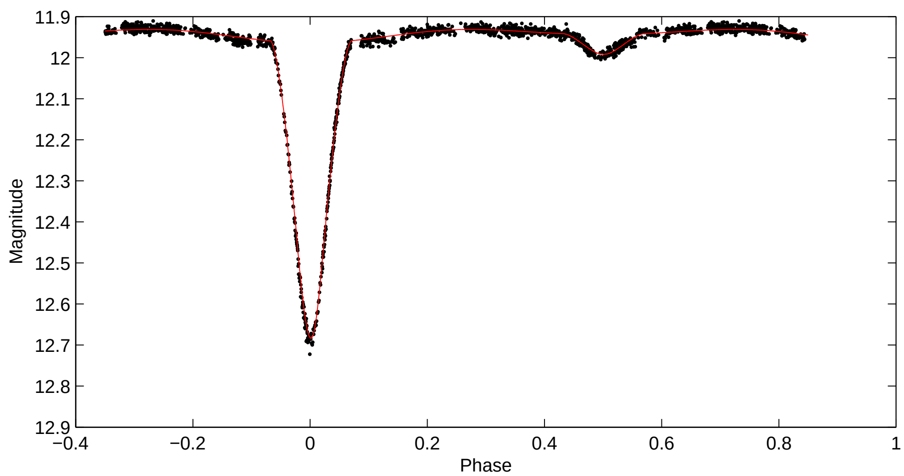

Fig. 7. Light curve analysis of DD Her, based on the Super WASP photometry.

3.4 DD Her

Another system in our sample of stars is DD Her (also TYC 2103-352-1), discovered as a variable by Hoffmeister (1929). It has relatively longer period of about 5.6 days, however it is also a system lacking of any detailed analysis. Due to its spectral classification as A2, we used the primary temperature of 8800 K for the whole LC fitting process.

The Super WASP photometry used for the LC analysis yielded a LC solution given in Table 1, while the LC fit is plotted in Fig. 7. As one can see, the primary star is absolutely dominant in the system and no third light was detected. Due to its deep and well-covered eclipses we derived only the primary minima for a period analysis and the $O-C$ diagram (plotted in Fig. 8). Also the ASAS and NSVS photometry was used for deriving two minima times. The older observations suffer from large scatter and are almost useless for any analysis. More recent data points show no variation.

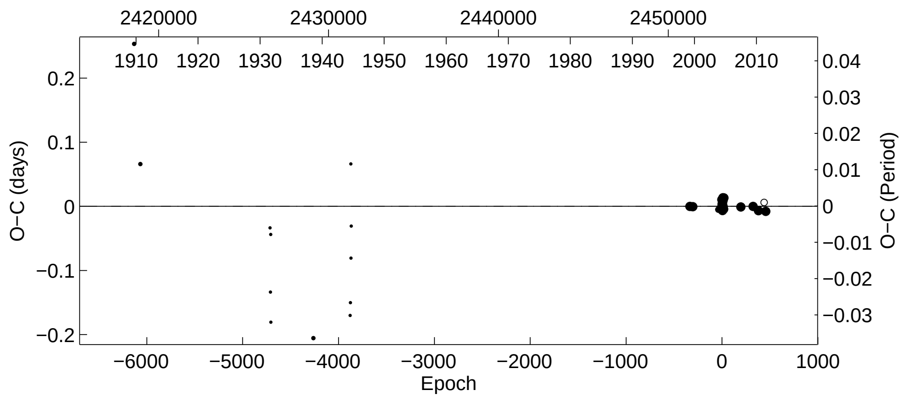

Fig. 8. O-C diagram of times of minima for DD Her.

3.5 VX Lac

The system VX Lac (also TYC 3214-1295-1) is probably the most studied star in our sample of binaries. Cannon (1934) derived its spectral type as F0, and since then no other more recent classification was carried out. The system was also included into the study of eclipsing binaries with period changes and third bodies by Zasche et al. (2008), who discovered a variation of about 68 yr and 0.02 days semiamplitude.

We collected the Super WASP photometry for a LC solution and analysed the system using the PHOEBE program. The primary temperature was set to 7228 K using the F0 spectral classification and also the Tycho-2 data from Ammons et al. (2006). The result is plotted in Fig. 9 and the LC parameters are given in Table 2. As one can see, the primary is the dominant component in the system. No third light was detected, which sets some constraints on the third-body hypothesis as resulted from the period analysis. There was also found that either of the stars is probably slightly physically variable, because in the outside-eclipse region there were seen some period-to-period deviations, which cause a slightly larger scatter of the data near quadratures.

The analysis of period was performed on the already published data as well as our new derived times of minima from the Super WASP and NSVS photometry. Our updated solution as presented in Fig. 10 represents only a slight correction of the already published one by Zasche et al. (2008). New values of period, eccentricity and semiamplitude are: 49.3 yr, 0.239, and 0.0144 days, respectively. However, even such a result is able to explain a non-detection of the third light in the LC solution. The potential third body is probably so small (hence has so low luminosity) that it cannot be detected in the LC solution.

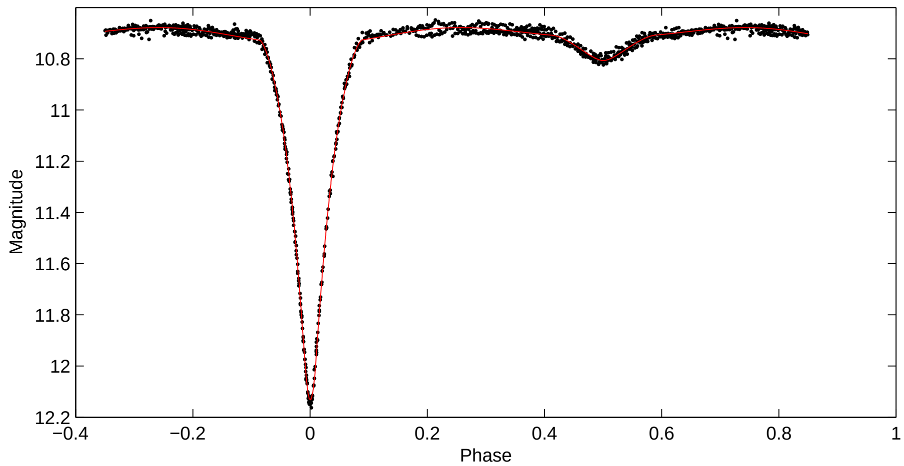

Fig. 9. Light curve analysis of VX Lac, based on the Super WASP photometry.

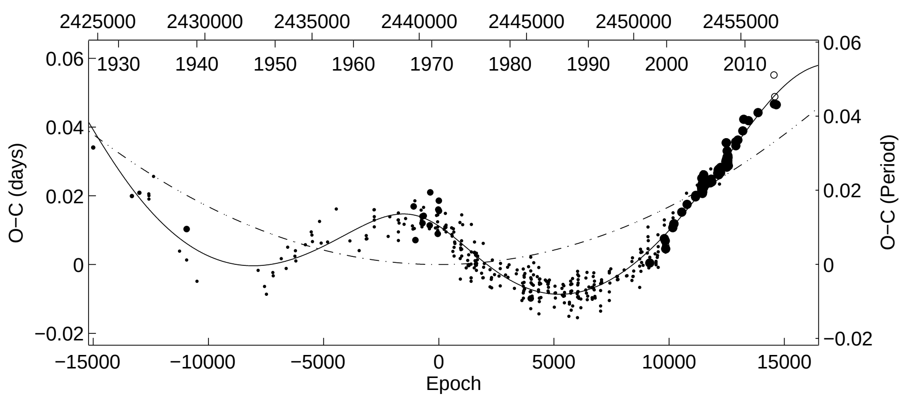

Fig. 10. O-C diagram of times of minima for VX Lac. The solid line represents the final fit, while the dash-dotted line stands for the quadratic ephemerides term.

Table 2
The light-curve parameters as derived from our analysis.

Parameter	VX Lac	WX Lib	RZ Lyn	TY Tri
$JD_0 - 2400000$	40908.9074 ± 0.0012	54564.5560 ± 0.0007	45347.3639 ± 0.0056	35778.5110 ± 0.0658
P [d]	1.07449709 ± 0.0000014	0.9200078 ± 0.0000003	1.1469092 ± 0.0000007	6.7620349 ± 0.0000381
i [deg]	86.84 ± 0.25	85.05 ± 0.17	76.03 ± 0.36	89.94 ± 0.27
T_1 [K]	7228 (fixed)	5200 (fixed)	8800 (fixed)	5720 (fixed)
T_2 [K]	4486 ± 36	5035 ± 27	6119 ± 62	5487 ± 40
Ω_1	4.589 ± 0.019	4.808 ± 0.023	3.961 ± 0.025	8.871 ± 0.032
Ω_2	5.021 ± 0.018	5.728 ± 0.029	4.295 ± 0.046	12.906 ± 0.041
L_1 [%]	94.1 ± 0.9	64.3 ± 1.0	83.8 ± 0.8	74.0 ± 0.7
L_2 [%]	5.9 ± 0.8	35.5 ± 0.9	13.4 ± 0.7	26.0 ± 0.3
L_3 [%]	0.0 ± 0.0	0.2 ± 0.4	2.8 ± 0.4	0.0 ± 0.0

3.6 WX Lib

The star WX Lib is relatively seldom studied system. It is the southernmost star in our sample, hence it was also observed by the ASAS survey. It is also the star with the shortest orbital period in our sample, of about 0.92 days

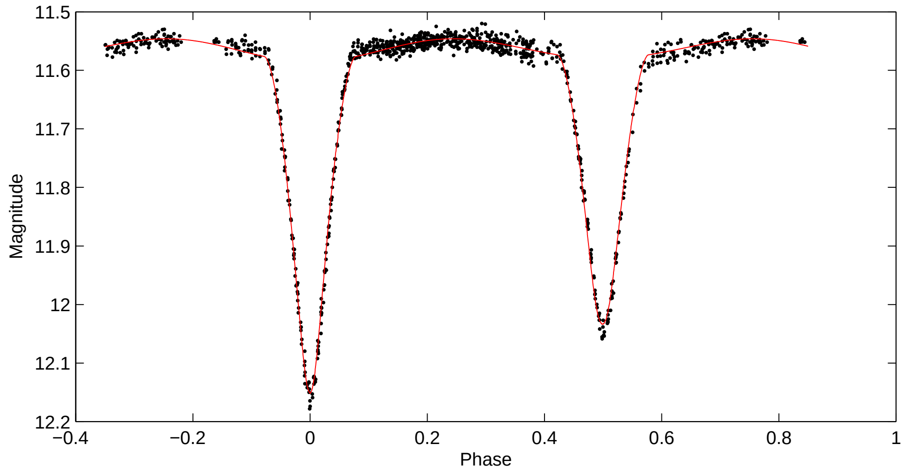

Fig. 11. Light curve analysis of WX Lib, based on the Super WASP photometry.

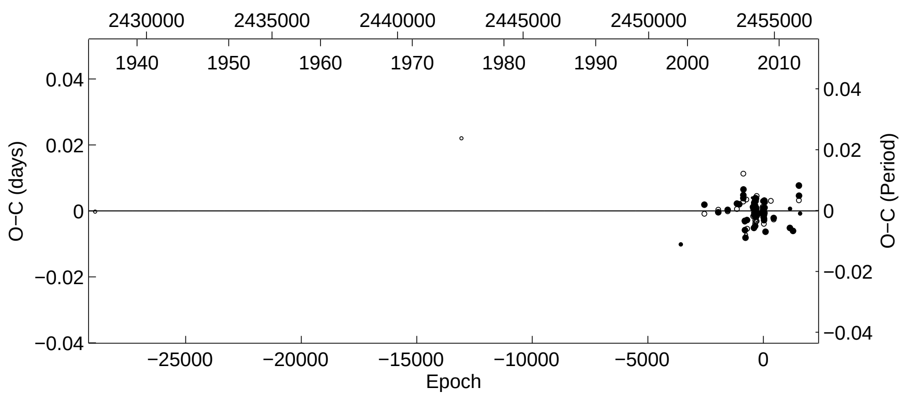

Fig. 12. O-C diagram of times of minima for WX Lib.

only (while the GCVS and VSX still presents the period 0.46 days).

Due to lacking relevant information about the system, we fixed the primary temperature to the value of 5200 K in agreement with the photometric indices found in various databases. The LC shows two rather similar and relatively deep eclipses. The LC solution (see Fig. 11 and Table 2) reveals that both stars are somehow similar, with the primary slightly dominating. The value of the third light remains negligible.

The period variation was studied using the Super WASP as well as the ASAS, CRTS, and OMC photometric data. Because of only very poor coverage of the time interval since its discovery to the nowadays time we are not able to identify any period variation in this time interval.

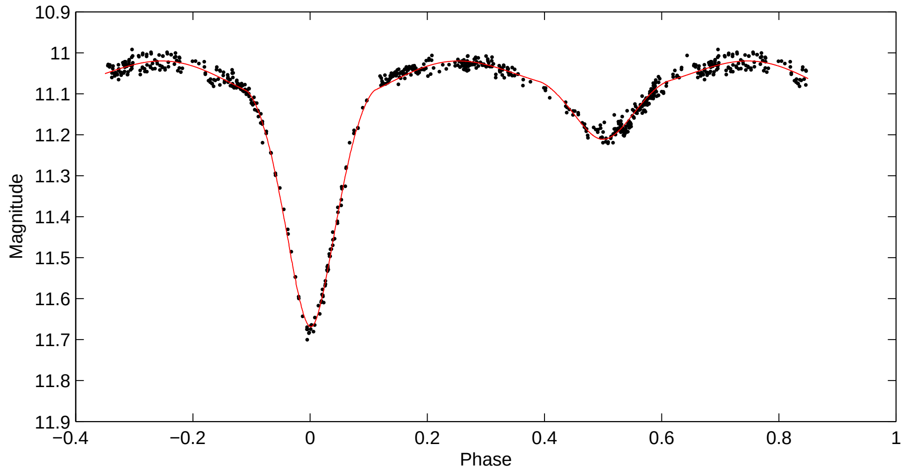

Fig. 13. Light curve analysis of RZ Lyn, based on the Super WASP photometry.

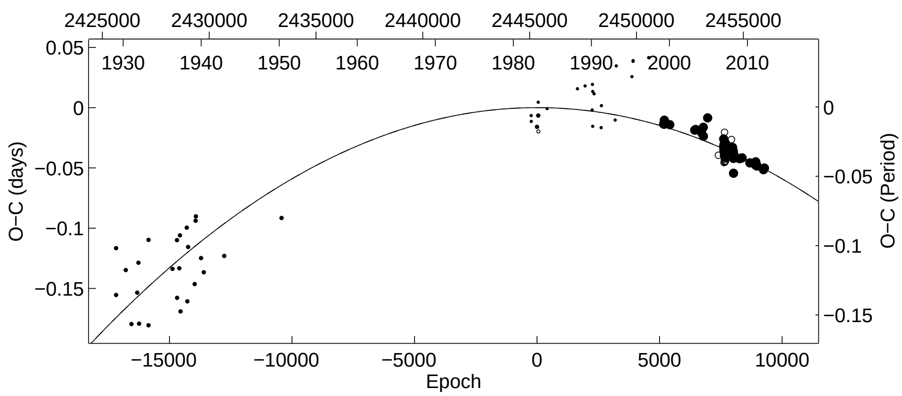

Fig. 14. O-C diagram of times of minima for RZ Lyn.

3.7 RZ Lyn

RZ Lyn (also GSC 02995-00972) is another rather neglected eclipsing binary, briefly studied by Huth (1953), who classified it as a β Lyrae type star and giving its correct orbital period of about 1.147 days. Its spectral of A2 type was given by Goetz (1961). Since then only several publications with the times of minima were published.

We carried out an analysis of the LC of this system, using the Super WASP photometry. The results given in Table 2 and the plot in Fig. 13 show that the system contains one larger component and slightly smaller secondary revolving on mildly inclined orbit. The amount of the third light is rather negligible.

For the period analysis we collected the already published data from the $O-C$ gateway and combined them with our derived minima times from the Super WASP and NSVS photometry. As one can see from our Fig. 14, the system obviously undergoes a mass transfer between the components. Such an effect

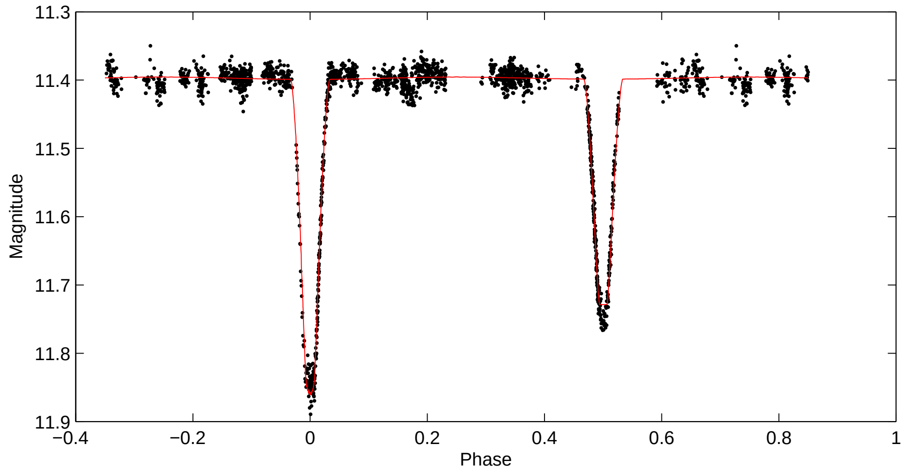

Fig. 15. Light curve analysis of TY Tri, based on the Super WASP photometry.

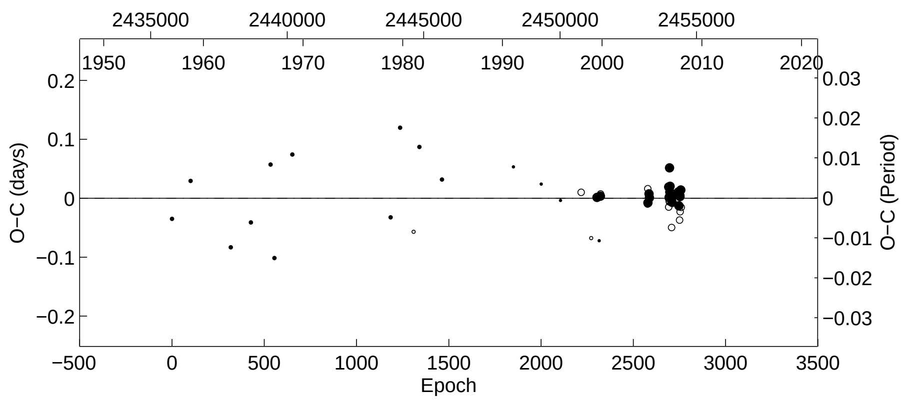

Fig. 16. O-C diagram of times of minima for TY Tri.

is displayed in the $O-C$ diagram as quadratic ephemerides, here in our case the rate is of about $-5.904 \cdot 10^{-10}$ days.

3.8 TY Tri

The eclipsing binary TY Tri (also TYC 2312-190-1) was discovered as a variable by Weber (1963). No detailed analysis was carried out for this star, only several publications with the times of minima were published during the last decades. For the light curve analysis we fixed the primary temperate at a value of 5720 K, in agreement with Pickles & Depagne (2010) and Ammons et al. (2006).

The LC analysis revealed (see Fig. 15 and Table 2) that here we deal with the most detached system in our sample of stars, but still moving on circular orbit. We see the system almost exactly edge-on. The third light was not detected. The LC solution was used for deriving the minima times (both from the Super

WASP as well as from the NSVS photometry). The final plot is given in Fig. 16, where we were not able to detect any period variation over the time span of more than 50 years.

4 Discussion and conclusions

The very first LC solution for eight Algol-type eclipsing binaries (based on the Super WASP photometry) led to several interesting results:

- The Super WASP survey served as a unique source of photometric data suitable for the LC analysis of many eclipsing binaries never studied before.
- The effects of the second order, like the third light, are also detectable in these data.
- For two of the systems (EI Aur, and BP Dra) the amount of the third light is so large that these cannot easily be considered as pure binaries in any future more detailed study.
- The method of using the light curve templates for deriving the times of minima provides reliable and sufficiently precise minima suitable for a period analysis.
- For RZ Lyn we found a steady period decrease (probably due to mass transfer), while for two other systems (XY Dra and VX Lac) there were detected the third-body period modulations with their respective periods of 18, and 49 years, respectively.

All of the presented systems were never been studied before concerning their light curves, hence we can consider this study as a good starting point for any other future investigators. Especially, a special focus should be take to these systems, where a larger fraction of the third light was detected and these systems, where a third body variation in the $O-C$ diagram was detected.

5 Acknowledgments

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Table 3
New heliocentric minima times for the studied systems.

Star	HJD 2400000+	Error [days]	Type	Filter	Source	Star	HJD 2400000+	Error [days]	Type	Filter	Source
EI Aur	53239.79843	0.00329	Prim	W	Super WASP	XY Dra	54648.48213	0.00346	Prim	W	Super WASP
EI Aur	53241.63954	0.00484	Sec	W	Super WASP	XY Dra	54655.42973	0.00442	Prim	W	Super WASP
EI Aur	53249.60626	0.00239	Prim	W	Super WASP	XY Dra	54662.36851	0.00348	Prim	W	Super WASP
EI Aur	53258.81413	0.00597	Sec	W	Super WASP	XY Dra	54664.68717	0.00709	Prim	W	Super WASP
EI Aur	53260.65985	0.00493	Prim	W	Super WASP	XY Dra	54669.31447	0.00865	Prim	W	Super WASP
EI Aur	53263.72284	0.00822	Sec	W	Super WASP	XY Dra	54671.63742	0.00484	Prim	W	Super WASP
EI Aur	53271.69447	0.00324	Prim	W	Super WASP	XY Dra	54676.25627	0.00619	Prim	W	Super WASP
EI Aur	53274.75490	0.00549	Sec	W	Super WASP	XY Dra	54678.58136	0.00540	Prim	W	Super WASP
EI Aur	53276.60882	0.00425	Prim	W	Super WASP	XY Dra	54685.52612	0.00294	Prim	W	Super WASP
EI Aur	54021.81939	0.00646	Sec	W	Super WASP	BP Dra	54605.75377	0.00331	Sec	W	Super WASP
EI Aur	54023.65741	0.00135	Prim	W	Super WASP	BP Dra	54606.74790	0.00364	Sec	W	Super WASP
EI Aur	54031.63289	0.00416	Sec	W	Super WASP	BP Dra	54607.74552	0.00252	Sec	W	Super WASP
EI Aur	54050.64116	0.00567	Prim	W	Super WASP	BP Dra	54608.72035	0.00416	Sec	W	Super WASP
EI Aur	54056.78341	0.00574	Prim	W	Super WASP	BP Dra	54609.70607	0.00376	Sec	W	Super WASP
EI Aur	54066.59413	0.00507	Prim	W	Super WASP	BP Dra	54613.65078	0.00044	Sec	W	Super WASP
EI Aur	54068.44404	0.00341	Sec	W	Super WASP	BP Dra	54614.64111	0.00399	Sec	W	Super WASP
EI Aur	54069.65880	0.00694	Sec	W	Super WASP	BP Dra	54616.61016	0.00336	Sec	W	Super WASP
EI Aur	54071.50796	0.00618	Prim	W	Super WASP	BP Dra	54618.58910	0.00426	Sec	W	Super WASP
EI Aur	54077.63090	0.00380	Prim	W	Super WASP	BP Dra	54619.57775	0.00327	Sec	W	Super WASP
EI Aur	54083.77107	0.01188	Prim	W	Super WASP	BP Dra	54620.56434	0.00286	Sec	W	Super WASP
EI Aur	54085.60965	0.00159	Sec	W	Super WASP	BP Dra	54621.54850	0.00565	Sec	W	Super WASP
EI Aur	54087.44571	0.00367	Prim	W	Super WASP	BP Dra	54622.52987	0.00732	Sec	W	Super WASP
EI Aur	54091.73708	0.05763	Sec	W	Super WASP	BP Dra	54623.53236	0.00492	Sec	W	Super WASP
EI Aur	54092.35800	0.00456	Prim	W	Super WASP	BP Dra	54624.52560	0.00456	Sec	W	Super WASP
EI Aur	54093.57255	0.00591	Prim	W	Super WASP	BP Dra	54625.49420	0.00339	Sec	W	Super WASP
EI Aur	54109.53910	0.00271	Prim	W	Super WASP	BP Dra	54626.47436	0.00432	Sec	W	Super WASP
EI Aur	54111.37387	0.00574	Sec	W	Super WASP	BP Dra	54639.80828	0.00666	Prim	W	Super WASP
EI Aur	54114.43525	0.00562	Prim	W	Super WASP	BP Dra	54640.77902	0.00321	Prim	W	Super WASP
EI Aur	54115.65588	0.00512	Prim	W	Super WASP	BP Dra	54641.78471	0.00518	Prim	W	Super WASP
EI Aur	54116.27000	0.00535	Sec	W	Super WASP	BP Dra	54642.76968	0.00240	Prim	W	Super WASP
EI Aur	54120.55881	0.00533	Prim	W	Super WASP	BP Dra	54643.74851	0.00445	Prim	W	Super WASP
EI Aur	54122.41118	0.00531	Sec	W	Super WASP	BP Dra	54644.74041	0.00426	Prim	W	Super WASP
EI Aur	54123.63145	0.00675	Sec	W	Super WASP	BP Dra	54645.73031	0.00209	Prim	W	Super WASP
EI Aur	54124.24099	0.01334	Prim	W	Super WASP	BP Dra	54646.72234	0.00163	Prim	W	Super WASP
EI Aur	54125.47803	0.02013	Prim	W	Super WASP	BP Dra	54647.70233	0.00203	Prim	W	Super WASP
EI Aur	54135.28435	0.00480	Prim	W	Super WASP	BP Dra	54649.67851	0.00331	Prim	W	Super WASP
EI Aur	54136.51641	0.00560	Prim	W	Super WASP	BP Dra	54650.66298	0.00324	Prim	W	Super WASP
EI Aur	54139.57493	0.00679	Sec	W	Super WASP	BP Dra	54651.64956	0.00372	Prim	W	Super WASP
EI Aur	54141.42195	0.00118	Prim	W	Super WASP	BP Dra	54652.63660	0.00316	Prim	W	Super WASP
EI Aur	54143.26039	0.00200	Sec	W	Super WASP	BP Dra	54655.59807	0.00346	Prim	W	Super WASP
EI Aur	54372.65157	0.00222	Sec	W	Super WASP	BP Dra	54656.58499	0.00065	Prim	W	Super WASP
EI Aur	54381.84920	0.00103	Prim	W	Super WASP	BP Dra	54657.57141	0.00412	Prim	W	Super WASP
EI Aur	54383.69290	0.00270	Sec	W	Super WASP	BP Dra	54659.54592	0.00355	Prim	W	Super WASP
EI Aur	54388.60045	0.00236	Sec	W	Super WASP	BP Dra	54660.53074	0.00128	Prim	W	Super WASP
EI Aur	54389.83119	0.00707	Sec	W	Super WASP	BP Dra	54661.51919	0.00093	Prim	W	Super WASP
EI Aur	54393.50781	0.00638	Sec	W	Super WASP	BP Dra	54662.50413	0.00138	Prim	W	Super WASP
EI Aur	54394.73397	0.00491	Sec	W	Super WASP	BP Dra	54663.48917	0.00323	Prim	W	Super WASP
EI Aur	54396.57223	0.00222	Prim	W	Super WASP	BP Dra	54664.47471	0.00485	Prim	W	Super WASP
EI Aur	54399.64381	0.00966	Sec	W	Super WASP	BP Dra	54665.46945	0.00265	Prim	W	Super WASP
EI Aur	54405.77427	0.00712	Sec	W	Super WASP	BP Dra	54666.44639	0.00388	Prim	W	Super WASP
EI Aur	54407.61117	0.00112	Prim	W	Super WASP	BP Dra	54669.41122	0.00391	Prim	W	Super WASP
EI Aur	54409.45212	0.00863	Sec	W	Super WASP	BP Dra	54670.38242	0.00520	Prim	W	Super WASP
EI Aur	54410.68184	0.00330	Sec	W	Super WASP	BP Dra	54671.38573	0.00531	Prim	W	Super WASP
EI Aur	54418.65078	0.00501	Prim	W	Super WASP	BP Dra	54673.36105	0.00745	Prim	W	Super WASP
EI Aur	54420.49582	0.00446	Sec	W	Super WASP	BP Dra	54684.71350	0.00374	Sec	W	Super WASP
EI Aur	54436.44208	0.00460	Sec	W	Super WASP	BP Dra	54685.70796	0.00596	Sec	W	Super WASP
EI Aur	54439.50820	0.00335	Prim	W	Super WASP	BP Dra	54686.67285	0.00552	Sec	W	Super WASP
EI Aur	54447.48593	0.03211	Sec	W	Super WASP	BP Dra	54688.65672	0.00255	Sec	W	Super WASP
EI Aur	54452.38034	0.00175	Sec	W	Super WASP	DD Her	53159.72406	0.00410	Prim	W	Super WASP
XY Dra	54231.74155	0.00800	Prim	W	Super WASP	DD Her	53165.35782	0.00489	Prim	W	Super WASP
XY Dra	54252.57564	0.00106	Prim	W	Super WASP	DD Her	53171.00389	0.02646	Prim	W	Super WASP
XY Dra	54266.47097	0.00329	Prim	W	Super WASP	DD Her	53176.64755	0.00272	Prim	W	Super WASP
XY Dra	54268.78705	0.00408	Prim	W	Super WASP	DD Her	53182.28829	0.00423	Prim	W	Super WASP
XY Dra	54273.41399	0.01264	Prim	W	Super WASP	DD Her	53193.57817	0.00862	Prim	W	Super WASP
XY Dra	54275.72631	0.00364	Prim	W	Super WASP	DD Her	53199.21100	0.01450	Prim	W	Super WASP
XY Dra	54280.36463	0.00492	Prim	W	Super WASP	DD Her	53204.86915	0.00085	Prim	W	Super WASP
XY Dra	54282.67744	0.00736	Prim	W	Super WASP	DD Her	53221.80448	0.00422	Prim	W	Super WASP
XY Dra	54287.30232	0.00328	Prim	W	Super WASP	DD Her	53227.44355	0.00011	Prim	W	Super WASP
XY Dra	54289.61817	0.00214	Prim	W	Super WASP	DD Her	53238.72048	0.00310	Prim	W	Super WASP
XY Dra	54296.56650	0.00445	Prim	W	Super WASP	DD Her	53261.29036	0.00998	Prim	W	Super WASP
XY Dra	54303.51362	0.00506	Prim	W	Super WASP	DD Her	53278.23823	0.06578	Prim	W	Super WASP
XY Dra	54317.41155	0.00708	Prim	W	Super WASP	DD Her	52956.54640	0.01290	Prim	V	ASAS
XY Dra	54324.33750	0.00906	Prim	W	Super WASP	DD Her	51449.76387	0.00529	Prim	C	NSVS
XY Dra	54333.60940	0.00314	Prim	W	Super WASP	VX Lac	53164.64384	0.00064	Prim	W	Super WASP
XY Dra	54576.70876	0.00771	Prim	W	Super WASP	VX Lac	53165.71872	0.00093	Prim	W	Super WASP
XY Dra	54597.54636	0.00189	Prim	W	Super WASP	VX Lac	53177.54044	0.00093	Prim	W	Super WASP
XY Dra	54606.81787	0.00920	Prim	W	Super WASP	VX Lac	53178.61181	0.00502	Prim	W	Super WASP
XY Dra	54613.75888	0.00567	Prim	W	Super WASP	VX Lac	53179.68697	0.00016	Prim	W	Super WASP
XY Dra	54618.38035	0.00658	Prim	W	Super WASP	VX Lac	53180.76028	0.00367	Prim	W	Super WASP
XY Dra	54620.69641	0.00542	Prim	W	Super WASP	VX Lac	53191.50581	0.00255	Prim	W	Super WASP
XY Dra	54627.64153	0.00286	Prim	W	Super WASP	VX Lac	53192.58112	0.00257	Prim	W	Super WASP
XY Dra	54636.89985	0.00560	Prim	W	Super WASP	VX Lac	53193.65503	0.00444	Prim	W	Super WASP
XY Dra	54641.53766	0.00398	Prim	W	Super WASP	VX Lac	53194.72972	0.00727	Prim	W	Super WASP

Table 4
New heliocentric minima times for the studied systems - cont.1

Star	HJD 2400000+	Error [days]	Type	Filter	Source	Star	HJD 2400000+	Error [days]	Type	Filter	Source
VX Lac	53205.47578	0.00122	Prim	W	Super WASP	WX Lib	54203.45147	0.00373	Sec	W	Super WASP
VX Lac	53206.54973	0.00028	Prim	W	Super WASP	WX Lib	54207.59244	0.00055	Prim	W	Super WASP
VX Lac	53207.62366	0.00000	Prim	W	Super WASP	WX Lib	54211.27564	0.00301	Prim	W	Super WASP
VX Lac	53208.69909	0.00187	Prim	W	Super WASP	WX Lib	54212.65320	0.00299	Sec	W	Super WASP
VX Lac	53209.77090	0.00566	Prim	W	Super WASP	WX Lib	54213.57224	0.00253	Sec	W	Super WASP
VX Lac	53219.44361	0.01045	Prim	W	Super WASP	WX Lib	54214.49680	0.00271	Sec	W	Super WASP
VX Lac	53220.51806	0.00044	Prim	W	Super WASP	WX Lib	54215.41445	0.00190	Sec	W	Super WASP
VX Lac	53222.66684	0.00256	Prim	W	Super WASP	WX Lib	54216.33211	0.00342	Sec	W	Super WASP
VX Lac	53223.73986	0.00171	Prim	W	Super WASP	WX Lib	54230.59395	0.00334	Prim	W	Super WASP
VX Lac	53235.56067	0.00081	Prim	W	Super WASP	WX Lib	54231.51311	0.00368	Prim	W	Super WASP
VX Lac	53236.63663	0.00340	Prim	W	Super WASP	WX Lib	54232.43401	0.00175	Prim	W	Super WASP
VX Lac	53247.38067	0.00225	Prim	W	Super WASP	WX Lib	54233.35299	0.00100	Prim	W	Super WASP
VX Lac	53248.45479	0.00574	Prim	W	Super WASP	WX Lib	54236.57262	0.00463	Sec	W	Super WASP
VX Lac	53249.52955	0.00061	Prim	W	Super WASP	WX Lib	54237.49040	0.00451	Sec	W	Super WASP
VX Lac	53250.60386	0.00269	Prim	W	Super WASP	WX Lib	54238.41622	0.00475	Sec	W	Super WASP
VX Lac	53252.75332	0.00219	Prim	W	Super WASP	WX Lib	54239.33132	0.00240	Sec	W	Super WASP
VX Lac	53261.35027	0.00690	Prim	W	Super WASP	WX Lib	54244.39194	0.00406	Prim	W	Super WASP
VX Lac	53262.42319	0.00391	Prim	W	Super WASP	WX Lib	54246.23718	0.00341	Prim	W	Super WASP
VX Lac	53263.49786	0.00306	Prim	W	Super WASP	WX Lib	54254.51637	0.00256	Prim	W	Super WASP
VX Lac	53264.57568	0.00042	Prim	W	Super WASP	WX Lib	54257.27174	0.00161	Prim	W	Super WASP
VX Lac	53265.64647	0.00178	Prim	W	Super WASP	WX Lib	54268.31725	0.00253	Prim	W	Super WASP
VX Lac	53266.72288	0.00514	Prim	W	Super WASP	WX Lib	54269.23159	0.00974	Prim	W	Super WASP
VX Lac	53275.31899	0.00179	Prim	W	Super WASP	WX Lib	54271.53030	0.00342	Sec	W	Super WASP
VX Lac	53276.39168	0.00146	Prim	W	Super WASP	WX Lib	54272.45350	0.00026	Sec	W	Super WASP
VX Lac	53277.46644	0.00017	Prim	W	Super WASP	WX Lib	54273.37246	0.00230	Sec	W	Super WASP
VX Lac	53278.54135	0.00128	Prim	W	Super WASP	WX Lib	54274.29395	0.00122	Sec	W	Super WASP
VX Lac	53942.58409	0.00119	Prim	W	Super WASP	WX Lib	54287.17233	0.00722	Sec	W	Super WASP
VX Lac	53943.65925	0.00521	Prim	W	Super WASP	WX Lib	54291.31331	0.00416	Prim	W	Super WASP
VX Lac	53944.73254	0.00074	Prim	W	Super WASP	WX Lib	54292.23335	0.00323	Prim	W	Super WASP
VX Lac	53955.47843	0.00100	Prim	W	Super WASP	WX Lib	54295.45465	0.00216	Sec	W	Super WASP
VX Lac	53969.44742	0.00011	Prim	W	Super WASP	WX Lib	54296.37446	0.00315	Sec	W	Super WASP
VX Lac	53970.52161	0.00018	Prim	W	Super WASP	WX Lib	54297.29830	0.00350	Sec	W	Super WASP
VX Lac	53971.59617	0.00143	Prim	W	Super WASP	WX Lib	54298.21067	0.00324	Sec	W	Super WASP
VX Lac	53972.67090	0.00867	Prim	W	Super WASP	WX Lib	54301.43240	0.00495	Prim	W	Super WASP
VX Lac	53973.74376	0.01138	Prim	W	Super WASP	WX Lib	54337.31192	0.00837	Prim	W	Super WASP
VX Lac	53997.38411	0.00155	Prim	W	Super WASP	WX Lib	54338.23273	0.00497	Prim	W	Super WASP
VX Lac	53998.45861	0.00176	Prim	W	Super WASP	WX Lib	54518.55510	0.00061	Prim	W	Super WASP
VX Lac	54056.48221	0.00697	Prim	W	Super WASP	WX Lib	54525.45469	0.00001	Sec	W	Super WASP
VX Lac	54057.55518	0.01641	Prim	W	Super WASP	WX Lib	54528.67506	0.00163	Prim	W	Super WASP
VX Lac	54303.61812	0.00137	Prim	W	Super WASP	WX Lib	54536.49703	0.00071	Sec	W	Super WASP
VX Lac	54304.69283	0.00164	Prim	W	Super WASP	WX Lib	54547.53886	0.00359	Sec	W	Super WASP
VX Lac	54315.44317	0.00666	Prim	W	Super WASP	WX Lib	54553.51620	0.00018	Prim	W	Super WASP
VX Lac	54316.51092	0.00706	Prim	W	Super WASP	WX Lib	54554.43505	0.00244	Prim	W	Super WASP
VX Lac	54318.66166	0.00080	Prim	W	Super WASP	WX Lib	54555.35670	0.00010	Prim	W	Super WASP
VX Lac	54319.73556	0.00144	Prim	W	Super WASP	WX Lib	54557.65679	0.00086	Sec	W	Super WASP
VX Lac	54329.41159	0.00045	Prim	W	Super WASP	WX Lib	54558.57649	0.00009	Sec	W	Super WASP
VX Lac	54330.48057	0.00073	Prim	W	Super WASP	WX Lib	54560.41698	0.00049	Sec	W	Super WASP
VX Lac	54331.55560	0.00012	Prim	W	Super WASP	WX Lib	54561.33652	0.00325	Sec	W	Super WASP
VX Lac	54332.62991	0.00030	Prim	W	Super WASP	WX Lib	54564.55555	0.00134	Prim	W	Super WASP
VX Lac	54333.70456	0.00274	Prim	W	Super WASP	WX Lib	54565.47622	0.00016	Prim	W	Super WASP
VX Lac	54334.77826	0.00490	Prim	W	Super WASP	WX Lib	54566.39604	0.00054	Prim	W	Super WASP
VX Lac	54344.44749	0.00341	Prim	W	Super WASP	WX Lib	54571.45482	0.00103	Sec	W	Super WASP
VX Lac	54345.52456	0.00060	Prim	W	Super WASP	WX Lib	54572.37522	0.00028	Sec	W	Super WASP
VX Lac	54346.59859	0.00158	Prim	W	Super WASP	WX Lib	54573.29495	0.00006	Sec	W	Super WASP
VX Lac	54347.67305	0.00069	Prim	W	Super WASP	WX Lib	54574.67423	0.00154	Prim	W	Super WASP
VX Lac	54348.74674	0.00272	Prim	W	Super WASP	WX Lib	54581.57478	0.00042	Sec	W	Super WASP
VX Lac	54357.34618	0.00352	Prim	W	Super WASP	WX Lib	54582.49226	0.00125	Sec	W	Super WASP
VX Lac	54358.41811	0.00063	Prim	W	Super WASP	WX Lib	54583.41896	0.00113	Sec	W	Super WASP
VX Lac	54359.49267	0.00038	Prim	W	Super WASP	WX Lib	54584.33531	0.00174	Sec	W	Super WASP
VX Lac	54360.56791	0.00177	Prim	W	Super WASP	WX Lib	54586.63520	0.00011	Prim	W	Super WASP
VX Lac	54361.64171	0.00008	Prim	W	Super WASP	WX Lib	54588.47344	0.00010	Prim	W	Super WASP
VX Lac	54362.71659	0.00182	Prim	W	Super WASP	WX Lib	54592.61361	0.00380	Sec	W	Super WASP
VX Lac	54372.38510	0.00065	Prim	W	Super WASP	WX Lib	54594.45681	0.00167	Sec	W	Super WASP
VX Lac	54373.46159	0.00071	Prim	W	Super WASP	WX Lib	54600.43937	0.00109	Prim	W	Super WASP
VX Lac	54374.53624	0.00228	Prim	W	Super WASP	WX Lib	54601.35945	0.00031	Prim	W	Super WASP
VX Lac	54387.43025	0.00007	Prim	W	Super WASP	WX Lib	54609.17518	0.00461	Sec	W	Super WASP
VX Lac	54388.50380	0.00106	Prim	W	Super WASP	WX Lib	54612.39907	0.00464	Prim	W	Super WASP
VX Lac	54389.57750	0.00683	Prim	W	Super WASP	WX Lib	54614.23742	0.00184	Prim	W	Super WASP
VX Lac	54399.25015	0.00494	Prim	W	Super WASP	WX Lib	52214.85796	0.00135	Prim	V	ASAS
VX Lac	54402.47315	0.00069	Prim	W	Super WASP	WX Lib	52215.31522	0.00056	Sec	V	ASAS
VX Lac	54416.43920	0.00156	Prim	W	Super WASP	WX Lib	52770.54040	0.00101	Prim	V	ASAS
VX Lac	51493.78293	0.00245	Prim	C	NSVS	WX Lib	52771.00118	0.00140	Sec	V	ASAS
VX Lac	51494.32115	0.00452	Prim	C	NSVS	WX Lib	53143.14430	0.00133	Prim	V	ASAS
WX Lib	54151.47369	0.00134	Prim	W	Super WASP	WX Lib	53143.60384	0.00246	Sec	V	ASAS
WX Lib	54155.61096	0.00022	Sec	W	Super WASP	WX Lib	53510.22928	0.00343	Prim	V	ASAS
WX Lib	54156.53318	0.00088	Sec	W	Super WASP	WX Lib	53510.68764	0.00091	Sec	V	ASAS
WX Lib	54175.39377	0.00056	Prim	W	Super WASP	WX Lib	53824.86673	0.00125	Prim	V	ASAS
WX Lib	54179.53406	0.00129	Sec	W	Super WASP	WX Lib	53825.32650	0.00139	Sec	V	ASAS
WX Lib	54180.45331	0.00313	Sec	W	Super WASP	WX Lib	54239.79485	0.00092	Prim	V	ASAS
WX Lib	54181.37149	0.00156	Sec	W	Super WASP	WX Lib	54240.24947	0.00289	Sec	V	ASAS
WX Lib	54186.43204	0.00817	Prim	W	Super WASP	WX Lib	54607.79578	0.00083	Prim	V	ASAS
WX Lib	54199.31531	0.00019	Prim	W	Super WASP	WX Lib	54608.25407	0.00079	Sec	V	ASAS
WX Lib	54200.69220	0.00026	Sec	W	Super WASP	WX Lib	54973.03732	0.00069	Prim	V	ASAS

Table 5
New heliocentric minima times for the studied systems - cont.2

Star	HJD 2400000+	Error [days]	Type	Filter	Source
WX Lib	54973.49691	0.00168	Sec	V	ASAS
WX Lib	53605.90992	0.00158	Prim	V	CRTS
WX Lib	53821.18676	0.00528	Prim	V	CRTS
WX Lib	53832.22397	0.00454	Prim	V	CRTS
WX Lib	53855.22189	0.00180	Prim	V	CRTS
WX Lib	53873.16292	0.01015	Sec	V	CRTS
WX Lib	53878.22712	0.07436	Prim	V	CRTS
WX Lib	53886.05374	0.00578	Sec	V	CRTS
WX Lib	53914.10772	0.00011	Prim	V	CRTS
WX Lib	53920.08515	0.00390	Sec	V	CRTS
WX Lib	54120.19624	0.01175	Prim	V	CRTS
WX Lib	54188.26766	0.00072	Prim	V	CRTS
WX Lib	54237.02867	0.00511	Prim	V	CRTS
WX Lib	54266.01160	0.00393	Sec	V	CRTS
WX Lib	54318.91224	0.06814	Prim	V	CRTS
WX Lib	54651.95046	0.02253	Prim	V	CRTS
WX Lib	54861.26160	0.00586	Sec	V	CRTS
WX Lib	55743.07995	0.00280	Prim	V	CRTS
WX Lib	56029.20766	0.00551	Prim	V	CRTS
WX Lib	53765.07400	0.00339	Prim	V	OMC
WX Lib	53765.53210	0.00305	Sec	V	OMC
WX Lib	53765.99313	0.00367	Prim	V	OMC
WX Lib	53768.30057	0.00439	Sec	V	OMC
WX Lib	53770.59579	0.00515	Prim	V	OMC
WX Lib	55619.79983	0.00123	Prim	V	OMC
WX Lib	55624.40569	0.00575	Prim	V	OMC
WX Lib	55978.61573	0.00202	Prim	V	OMC
WX Lib	55980.91124	0.00224	Sec	V	OMC
WX Lib	55982.29267	0.00385	Prim	V	OMC
WX Lib	55983.67560	0.00313	Sec	V	OMC
RZ Lyn	53131.42044	0.00416	Prim	W	Super WASP
RZ Lyn	53132.55995	0.00572	Prim	W	Super WASP
RZ Lyn	53837.31985	0.00536	Sec	W	Super WASP
RZ Lyn	54084.49234	0.00285	Prim	W	Super WASP
RZ Lyn	54085.63346	0.00151	Prim	W	Super WASP
RZ Lyn	54092.51240	0.00421	Prim	W	Super WASP
RZ Lyn	54094.80424	0.00537	Prim	W	Super WASP
RZ Lyn	54098.80906	0.00444	Sec	W	Super WASP
RZ Lyn	54100.54461	0.00182	Prim	W	Super WASP
RZ Lyn	54101.68912	0.00028	Prim	W	Super WASP
RZ Lyn	54109.71604	0.00337	Prim	W	Super WASP
RZ Lyn	54114.86844	0.00616	Sec	W	Super WASP
RZ Lyn	54115.45404	0.00586	Prim	W	Super WASP
RZ Lyn	54118.88614	0.00397	Prim	W	Super WASP
RZ Lyn	54120.62547	0.00184	Sec	W	Super WASP
RZ Lyn	54121.75079	0.00086	Sec	W	Super WASP
RZ Lyn	54123.48066	0.00462	Prim	W	Super WASP
RZ Lyn	54139.53995	0.00173	Prim	W	Super WASP
RZ Lyn	54140.68419	0.00173	Prim	W	Super WASP
RZ Lyn	54141.82840	0.00538	Prim	W	Super WASP
RZ Lyn	54142.39263	0.00234	Sec	W	Super WASP
RZ Lyn	54143.53890	0.00265	Sec	W	Super WASP
RZ Lyn	54146.41102	0.00220	Prim	W	Super WASP
RZ Lyn	54147.56655	0.00283	Prim	W	Super WASP
RZ Lyn	54150.42389	0.00427	Sec	W	Super WASP
RZ Lyn	54152.71500	0.00285	Sec	W	Super WASP
RZ Lyn	54154.44729	0.00008	Prim	W	Super WASP
RZ Lyn	54155.59752	0.00053	Prim	W	Super WASP
RZ Lyn	54156.73595	0.00002	Prim	W	Super WASP
RZ Lyn	54157.31486	0.00420	Sec	W	Super WASP
RZ Lyn	54158.45739	0.00507	Sec	W	Super WASP
RZ Lyn	54159.61127	0.00105	Sec	W	Super WASP
RZ Lyn	54165.33117	0.00181	Sec	W	Super WASP
RZ Lyn	54166.49159	0.00318	Sec	W	Super WASP
RZ Lyn	54167.63178	0.00264	Sec	W	Super WASP
RZ Lyn	54169.35188	0.00120	Prim	W	Super WASP
RZ Lyn	54170.50493	0.00312	Prim	W	Super WASP
RZ Lyn	54171.64906	0.00043	Prim	W	Super WASP
RZ Lyn	54192.29469	0.00138	Prim	W	Super WASP
RZ Lyn	54194.58713	0.00269	Prim	W	Super WASP
RZ Lyn	54202.61239	0.00103	Prim	W	Super WASP
RZ Lyn	54205.47774	0.00374	Sec	W	Super WASP
RZ Lyn	54206.62493	0.00497	Sec	W	Super WASP
RZ Lyn	54208.34604	0.00135	Prim	W	Super WASP
RZ Lyn	54210.64324	0.00194	Prim	W	Super WASP
RZ Lyn	54213.50360	0.00322	Sec	W	Super WASP
RZ Lyn	54436.58182	0.00238	Prim	W	Super WASP
RZ Lyn	54437.73058	0.00373	Prim	W	Super WASP
RZ Lyn	54438.88004	0.00498	Prim	W	Super WASP
RZ Lyn	54439.45100	0.00514	Sec	W	Super WASP
RZ Lyn	54447.48858	0.00467	Sec	W	Super WASP
RZ Lyn	54497.37261	0.00198	Prim	W	Super WASP
RZ Lyn	54501.38003	0.00434	Sec	W	Super WASP
RZ Lyn	54530.62985	0.00208	Prim	W	Super WASP
RZ Lyn	54532.34972	0.00083	Sec	W	Super WASP
RZ Lyn	54533.49086	0.00192	Sec	W	Super WASP
RZ Lyn	54535.21150	0.00566	Prim	W	Super WASP
RZ Lyn	54536.36128	0.00184	Prim	W	Super WASP
RZ Lyn	54539.22670	0.00081	Sec	W	Super WASP
RZ Lyn	54544.38890	0.00211	Prim	W	Super WASP
RZ Lyn	54545.52136	0.00678	Prim	W	Super WASP
RZ Lyn	54553.56534	0.00292	Prim	W	Super WASP
RZ Lyn	54555.28354	0.00339	Sec	W	Super WASP
RZ Lyn	54556.43655	0.00468	Sec	W	Super WASP
RZ Lyn	54557.57995	0.00276	Sec	W	Super WASP
RZ Lyn	54559.29697	0.00325	Prim	W	Super WASP
RZ Lyn	51305.54688	0.00099	Prim	C	NSVS
RZ Lyn	51306.11615	0.00892	Prim	C	NSVS
RZ Lyn	51562.45080	0.00146	Sec	C	NSVS
RZ Lyn	51563.02362	0.00657	Prim	C	NSVS
TY Tri	53200.88439	0.02149	Sec	W	Super WASP
TY Tri	53214.43429	0.00670	Sec	W	Super WASP
TY Tri	53217.79158	0.00986	Prim	W	Super WASP
TY Tri	53241.46097	0.00276	Sec	W	Super WASP
TY Tri	53258.37890	0.00543	Prim	W	Super WASP
TY Tri	53261.75425	0.02789	Sec	W	Super WASP
TY Tri	53271.89645	0.00806	Prim	W	Super WASP
TY Tri	53971.76602	0.00916	Sec	W	Super WASP
TY Tri	53978.51322	0.01864	Sec	W	Super WASP
TY Tri	53981.92835	0.02444	Prim	W	Super WASP
TY Tri	53995.43489	0.01649	Prim	W	Super WASP
TY Tri	53998.80999	0.00447	Sec	W	Super WASP
TY Tri	54005.57006	0.00086	Sec	W	Super WASP
TY Tri	54009.00902	0.00579	Prim	W	Super WASP
TY Tri	54022.49202	0.00866	Prim	W	Super WASP
TY Tri	54029.26387	0.01225	Prim	W	Super WASP
TY Tri	54049.53258	0.00363	Prim	W	Super WASP
TY Tri	54056.29640	0.01190	Prim	W	Super WASP
TY Tri	54066.43039	0.00868	Sec	W	Super WASP
TY Tri	54076.57522	0.00655	Prim	W	Super WASP
TY Tri	54083.34766	0.00495	Prim	W	Super WASP
TY Tri	54086.67109	0.00998	Sec	W	Super WASP
TY Tri	54093.48381	0.00552	Sec	W	Super WASP
TY Tri	54103.61895	0.00645	Prim	W	Super WASP
TY Tri	54333.54585	0.00241	Prim	W	Super WASP
TY Tri	54350.42559	0.00102	Sec	W	Super WASP
TY Tri	54353.80826	0.00950	Prim	W	Super WASP
TY Tri	54360.58907	0.00525	Prim	W	Super WASP
TY Tri	54377.45125	0.05284	Sec	W	Super WASP
TY Tri	54387.63625	0.00354	Prim	W	Super WASP
TY Tri	54394.39614	0.00032	Prim	W	Super WASP
TY Tri	54397.75156	0.01359	Sec	W	Super WASP
TY Tri	54421.45550	0.00405	Prim	W	Super WASP
TY Tri	54438.33122	0.00176	Sec	W	Super WASP
TY Tri	51479.95978	0.00255	Prim	C	NSVS
TY Tri	51483.34452	0.00193	Sec	C	NSVS